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ABSTRACT

This study assessed the effects of Teams-Games-Tournament (TGT) and two variations on student attitudes, achievement, and classroom processes in mathematics and social studies classes. The two variations involved weighted scoring in the game component and the deletion of team competition. The experiment involved 128 seventh-grade students for a 12-week period. Neither TGT nor its variants had any significant impact on the social studies classes when compared to a traditionally structured control class. TGT and its variants had significant impact on the mathematics classes affecting a variety of dependent variables. (A 25-item bibliography and 8 tables are included.) (Author)

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THE EFFECTS OF TEAMS-GAMES-TOURNAMENT AND TWO STRUCTURAL VARIATIONS ON CLASSROOM PROCESS, STUDENT ATTITUDES AND STUDENT ACHIEVEMENT

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Introductory Statement

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through three programs to achieve its objectives. The Schools and Maturity program is studying the effects of school, family, and peer group experiences on the development of attitudes consistent with psychosocial maturity. The objectives are to formulate, assess, and research important educational goals other than traditional academic achievement. The School Organization program is currently concerned with authority-control structures, task structures, reward systems, and peer group processes in schools. The Careers program (formerly Careers and Curricula) bases its work upon a theory of career development. It has developed a self-administered vocational guidance device and a self-directed career program to promote vocational development and to foster satisfying curricular decisions for high school, college, and adult populations.

This report, prepared by the School Organization program, examines the effects on students of structural variations in the Teams-Games-Tournament instructional technique.

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INTRODUCTION

The use of both educational games and small groups in the classroom has been advocated for some time by various educators. A series of studies (DeVries, Edwards and Snyder, 1973) have examined the effects of a classroom technique called Teams-Games-Tournament (TGT) that combines the use of student teams and academic games. The results of the research indicate that teams promote mutual concern, increase cross-race and cross-sex interaction, and promote increased peer tutoring (DeVries and Edwards, 1972, 1973). Games increase student satisfaction with the class, decrease the perceived difficulty of the class, create generally positive attitudes toward class, and teach additional mathematics skills (Edwards and DeVries, 1972; Edwards, DeVries and Snyder, 1972). In general, the effects of teams and games in the TGT framework have been additive. Thus, games and teams are viewed as complementary techniques which, when used together, substantially alter the social and affective climate of the classroom.

The purpose of the present study was to continue the evaluation of the effects of TGT and to investigate how certain variations on the TGT structure might alter its effectiveness. To understand the theoretical issues underlying the variations tested, it will be necessary to briefly explain the TGT structure.

Teams-Games-Tournament

As the name implies, TGT consists of three main elements--teams, games and a tournament. As currently implemented, the teams are organized in a class in the following way. Students with varying achievement levels are assigned to four-person teams. Each team typically consists of one high achiever, two average achievers, and one low achiever. The objective in creating the teams is to make each team equal to all other teams in average achievement level.

Team assignments are made as precise as possible under the constraints of information available to the teacher.

In TGT classes the four-person teams do not compete on tasks as a team against other teams. Instead, each student competes in an instructional game against two or more individuals of his approximate achievement level from other teams. Team scores are created by summing the game scores of each of the members. Teams are competitively compared by ranking them on the basis of their total (or average) scores in a weekly tournament. The competition is made public by a newsletter given to each student by the teacher on the day following a tournament. The newsletter contains rankings of the teams by total (or average) scores for both the previous tournament and all preceeding tournaments. Thus, the team members in TGT are reward-interdependent but not task-interdependent and the rewards are given on an interteam competitive basis.

The instructional games used in TGT classes have been quite varied. Their common characteristic has been that they can be played by a small group of (three) individuals in a short period of time, permitting several plays of the game per class period. The games may involve strategic interaction (e.g., Allen's Equations) or non-strategic interaction (e.g., flashcard games).

In a TGT tournament, the game tables are numbered in an achievement hierarchy with table one being the top table (where the three highest achieving students play), and table ten (in a thirty member class) being the bottom table. At the end of a tournament the students total up their individual scores for however many rounds their table played. Each student compares his total to only those players who are at his table; points are awarded on the basis of

6 points for top scorer, 4 points for middle scorer, and 2 points for low scorer. These individual scores are summed for each team to form a team score. Thus it is possible for each team member, regardless of ability level, to contribute the same number of points to the team score. At the end of each tournament a bumping procedure is used which moves each winner up one table and each loser down one table in the hierarchy. In this manner table assignments are determined for each subsequent tournament and student achievement levels at each table remain approximately equal.

The three TGT components--teams, games and tournaments--alter the classroom structure in unique ways. The team component creates a reward interdependence among students--they depend on combined team scores to determine their ranking. Such interdependence increases the importance of, and peer support for, doing well academically. The game component provides a task structure which (1) has few of the aversive characteristics traditional classroom tasks have, and (2) creates intense and rewarding interpersonal interaction. The tournament component drastically increases the probability of success in the classroom for the majority of the students. Thus each TGT component involves a unique transformation of the classroom learning structure, and the additive effect of the various components becomes meaningful.

Variations of TGT Structure

The present study sought to determine the effects of changing two of the elements of the TGT structure. The first variation involved the tournament point system. Previously, the 6-4-2 system was used at every table in the hierarchy, thus the highest achiever on a team could receive a score of 2 at table 1 while the lowest achiever on the same team could get 6 at table 10.

While this enables all team members to contribute equally to their team score, it has some potential disadvantages. One is that the apparent inequity may affect learning of the high achieving students.

The concept of inequity in interpersonal settings has been elaborated by Adams (1965), and further systematic empirical evidence has supported Adams' theory (cf. Goodman & Friedman, 1971; Walster, et al., 1969). According to Adams, inequity exists for a Person whenever he perceives that the ratio of his outcomes and inputs and the ratio of Other's outcomes to Other's inputs are unequal. This may happen either (1) when Person and Other are in a direct exchange relationship, such as a husband and wife, or (2) when both are in an exchange relationship with a third party and Person compares himself to Other, for example, two classmates competing for the attention of their teacher. Outcomes refer to rewards such as grades or pay which Person receives for performing. Inputs are contributions Person brings to the role, such as academic ability, age, and effort. The research to date suggests that (1) imbalance between the Input/Outcome ratios between Person and Other lead to feelings of inequity (Penner, 1967; Lawler, 1965), and (2) such feelings of inequity result in greater dissatisfaction (Penner, 1967). Goodman & Friedman (1971) note that the effects of perceived inequity on actual performance are presently unclear, but the theory suggests that a decrement in performance will result.

The relevance of equity theory for TGT derives in part from an earlier study with TGT (Edwards, et al., 1972) which indicated that TGT facilitated academic achievement of low achievers much more than it did for average achievers.

Also, a comparison of teams using the 6-4-2 tournament scoring with teams using raw scores indicated less peer tutoring under the 6-4-2 scoring system (DeVries & Edwards, 1973). Both results suggest a performance decrement by high achieving students that might be due to perceived inequity on their part. A high achieving student might view the scoring as unfair because he receives no greater points than his low achieving teammate even though he faces stiffer competition and has to exhibit greater skills in order to win. A more equitable tournament scoring procedure would take into account both how a player performed at his table and where the table was in the hierarchy, so that winning at a higher level table could result in getting more points. This scoring variation would be expected to reduce the level of perceived inequity, particularly among high achievers, and to create greater satisfaction with TGT.

A second TGT variation involves deleting the use of explicit inter-team competition -- that is, not having the teams compete with one another. Various theorists of small group functioning suggest team competition is useful in creating within group cohesion and goal orientation (Deutsch, 1949; Coleman, 1959; Bronfenbrenner, 1970). Two small group studies have tested the effect of intergroup competition (by comparing groups being rewarded on a competitive basis with groups being rewarded on an absolute, noncompetitive basis). The two studies (Hammond & Goldman, 1961; Julian & Perry, 1967) focused on group productivity and obtained conflicting results. Unfortunately the two studies ignored possible effects on group process (such as cohesion and mutual concern), a dependent variable more likely to be affected by the structural variation examined. The present study will examine the role of intergroup competition in TGT with the expectation that competing groups will evidence more positive group process (e.g., greater cohesion) than will noncompeting groups.

TGT in Different Subject Areas

To date the reported research with TGT has employed only one instructional game - Equations - and used the technique only in mathematics classes (Edwards, et al., 1972; DeVries & Edwards, 1973). To evaluate the usefulness of TGT as a general instructional technique it is important to conduct tests in other subject areas, using various instructional games. Consequently, the present study examines the effects of TGT in both mathematics and social studies classes.

METHOD

Subjects

The subjects were 128 seventh grade students attending a junior high school in Baltimore, Maryland. The breakdown of the sample by race and sex was as follows: 32 white females, 32 black females, 33 white males and 31 black males. The students were randomly selected from the school's population of 550 seventh grade students (this number excluded those designated for enriched or special education classes). Two of the students' classes, mathematics and social studies, were involved in the present study.

Design

The study was conducted for a twelve-week period during the fall term of 1972. Prior to the opening of school, students were randomly assigned to one of four groups. All students in a group had identical block schedules for the school day. All four mathematics classes were taught by a male and all four social studies classes were taught by a female. Before random assignment was made, the entire sample was stratified on the basis of ability, race, and sex resulting in comparable groups on these three variables. All dependent variables were observed on a posttest only basis. Ability was based on the

composite raw score from the Iowa Test of Basic Skills (ITBS) which was available from the previous spring. The composite raw score was used as a covariate in the data analysis. Data analysis followed the general linear model regression analysis procedures described by Cohen (1968).

Treatments

Each of the four randomly formed groups used one of the four treatments described below in both their mathematics and social studies classes. TGT groups used the game Equations in mathematics and Ameri-Card in social studies.

1. Control group. This group received conventional instruction emphasizing individual achievement. Weekly quizzes were the main form of evaluation of student performance.

2. Teams-Games-Tournament (TGT). This group used the TGT structure as it has been implemented by the authors in previous research. Students were assigned to four-member teams on the basis of race, sex, and achievement. Tournaments were conducted once a week in both subject areas. After each tournament individual scores were totaled to form team scores. Newsletters were used weekly to foster interteam competition by emphasizing relative team standings and changes in those standings from week to week. Each student received a mimeo copy of the newsletter.

3. TGT-Weighted (TGT-W). This group used the same procedures used in the TGT condition with a modification in the tournament scoring. The game tables in the tournament hierarchy were divided into three groups (called leagues) to give them differential reward status. The scoring was as follows:

Position in Table Hierarchy	Tournament Scores		
	Top	Middle	Bottom
Tables 1-3	18	12	6
Tables 4-8	12	8	4
Tables 9 and below	6	4	2

4. TGT-Weighted-Non Competition (TGT-WNC). This group used the same procedures as TGT-W except that the newsletter did not report interteam competition. Instead each team received its own newsletter which reported how each member had done and what the group score was. The group score was compared to what it was in the previous week and what the theoretical maximum was.

In all groups, the students were allowed to work together on practice problems for part of a class period twice per week. In the control group, students' course grades were based entirely on individual performance. In each of the TGT groups, students were told part of their course grade would be based on their team's performance.

Dependent Variables

The dependent variables in the present study can be divided into four categories: attitudes, classroom process, achievement, and sociometric choice. The measures used in the mathematics and social studies classes are shown in Table 1. A more detailed description of the dependent variables by category is given below.

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Insert Table 1
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The tests and questionnaires were administered during the last week and a half of the experiment. The attitude and process questionnaire was given first in the mathematics class and then four days later to the same students in their social studies classes. The achievement tests were administered by the classroom teacher while the rest of the measures were given by the experimenters. The sociometric choice variables were measured in mathematics only.

Attitudes. Two of the three attitude measures, satisfaction and difficulty, were modifications of scales from the Learning Environment Inventory (LEI) by Walberg and Anderson (1968). Each scale consisted of five statements about the class to which the subject either agreed or disagreed. A study of the modified scales with seventh grade mathematics students revealed a slight

increase in the internal consistency over the original version (Edwards, DeVries, and Livingston, 1973). The third attitude measure, attitude toward class, consisted of three agree/disagree statements concerning the student's affective reaction to coming to class and doing the work of the class.

Classroom process. Three of the five process variables--competition, cohesiveness, and mutual concern--were measured by modified scales from the LEI (Walberg and Anderson, 1968). Estimates of the internal consistencies of the three scales are reported in Edwards, DeVries, and Livingston (1973). The normative climate measure was a five-item scale taken from a previous study by DeVries, et al. (1971). The scale measured how much pressure the subject reports being applied by classmates to do well in the class. The frequency-of-tutoring scale consisted of five items describing various helping behaviors that the subject agreed or disagreed he had engaged in during the experiment.

Achievement. In mathematics, two types of achievement tests were used. The first required divergent thinking, the second convergent thinking. The divergent solutions test devised by the authors consisted of two parts scored separately. The subjects' scores on each part were simply the total number of correct responses. The test conforms to the definition of the Divergent Production of Symbolic Relations factor from Guilford's model of the structure of intellect (Meeker, 1969). On Part I of the test, subjects were asked to complete twelve different equations of the form (____ + ____) + (____ - ____) = 20 so as to make the equality correct. They were allowed to use any numbers except 0 or 1.

Part II of the test specified the right hand side of an equation as well as a set of number and arithmetic operations and asked the student to complete as many correct equations as possible using the specified set. A pilot-test of the divergent solutions test with five seventh grade mathematics classes yielded correlations of .48 (Part I) and .43 (Part II) with the computations subtest of the Stanford Achievement Test in Mathematics. These moderate correlations indicate that the test is tapping a general mathematics ability dimension yet is sufficiently distinct from the convergent standardized test to prove useful as a separate dependent variable.

The math achievement test requiring convergent thinking also consisted of two parts: a twelve-item test of computational skills, and a seven-item test requiring subjects to indicate whether a given number sentence was correct or incorrect. Correlations of the computations and number sentences tests with pre-experiment ITBS composite raw scores were..52 and .50 respectively.

In social studies the achievement test consisted of three parts. The "Maps" section required the subject to identify 13 named states on a blank map of the U.S. The "States" part required subjects to identify regions in which seven named states were located. The "Capitols" section required the subjects to give the names of the capitol cities of 7 given states. These three skills were objectives of the social studies unit covered in the Ameri-Card game used in the social studies classes. Correlations of these three measures with the pre-experiment ITBS composite raw scores were .55, .06, and .49 respectively. The lack of a significant correlation between the States subtest and general ability reflects questionable validity and that variable was dropped from further analysis.

Sociometric choice. Additional data concerning student peer relationships were obtained using posttest sociometric items in the mathematics class. Students were presented with lists of their classmates and were asked to indicate (1) those who were their friends in school, and (2) those whom had they helped. The sociometric data are of interest in part because they provide an additional opportunity to measure group cohesion. Proctor and Loomis (1951) report a sociometric index of group cohesion defined by the number of reciprocal choices divided by the total number of possible reciprocal choices. A variation of this measure was calculated in the present study for both the "friends in school" and "students you helped" items. A second set of measures derived from the sociometric data is a simple numerical count of classmates listed by the respondents as (1) friends in school and (2) students they had helped.

RESULTS

The analyses for the attitude, classroom process and achievement variables employed the general linear model approach to analysis of covariance recommended by Cohen (1968). The advantages of this technique over traditional ANCOVA analysis are two-fold. First, the more readily available regression analysis computer programs can be used to perform most of the calculations. Second, terms representing interactions between the covariate and the treatment variables can be included in the analysis directly.

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Insert Tables 2 and 3
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Summaries of the results for the attitude, classroom process and achievement variables are listed in Table 2 for mathematics and Table 3 for social studies. Student ability accounted for a significant proportion of the variance for almost all the variables. The treatment factor proved significant for more of the dependent variables in mathematics than in social studies. More specifically, significant effects in mathematics were observed for one attitude measure (toward class, $P < .05$), one classroom process measure (frequency of tutoring, $P < .05$), and two achievement measures (solutions I and II, $P < .01$). Two marginally significant treatment effects were observed for two additional classroom process measures (cohesiveness, mutual concern, $P < .10$) taken in mathematics classes. In contrast, only one marginally significant treatment effect (normative climate, $P < .10$) was observed in social studies. For mathematics none of the ability-by-treatment interactions were significant. For social studies only one interaction effect (satisfaction, $P < .05$) was significant. Because of the many tests of significance for interaction effects, the probability of finding one significant effect due to chance alone is high.

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Insert Tables 4 through 6
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The details of the general linear model analyses for the three classes of dependent variables are given in Tables 4 through 6. In each analysis the independent variables were entered into the model in the order they are listed. The A effect represents the correlation of the ITBS ability score with the dependent variable. The B effect represents the multiple partial correlation of three treatment dummy variables, as suggested by Cohen (1968), with the dependent

variable. The multiple partial correlation of B with the dependent variable involves controlling for the subject's ability. The A X B interaction term is derived from the product of A times B (Cohen, 1968). Because subjects were randomly assigned to treatment groups, the main function of the ability covariate is to reduce within-group variance and thus increase the power of the treatment effect F tests. The incremental R^2 for the B effect is the amount of dependent variable variance due to between-group differences. It is analogous to the correlation ratio eta-squared in ANOVA (Kerlinger, 1973).

As table 4 indicates, treatment differences accounted for 7% of the variance on the attitude toward class variable ($F = 2.7$; $df = 3/103$; $P < .05$). in mathematics . No other significant treatment effects were noted for attitude variables in either mathematics or social studies. Table 5, which summarizes the results for classroom process variables, indicates a significant treatment effect in mathematics (explaining 8% of the variance) for frequency of tutoring ($F = 3.15$, $df = 3/103$; $P < .05$). Marginally significant treatment effects were also noted for cohesiveness ($F = 2.36$; $df = 3/103$; $P < .10$; 6% of variance), and mutual concern ($F = 2.52$; $df = 3/103$; $P < .10$; 6% of variance). In social studies a marginally significant treatment effect was detected for normative climate ($F = 2.16$; $df = 3/104$; $P < .10$; 6% of variance).

Significant treatment effects on achievement are described in Table 6. Treatment effects were observed for two of the four mathematics achievement variables: Solutions I ($F = 7.28$; $df = 3/99$; $P < .01$; 9% of variance), and Solutions II ($F = 10.01$; $df = 3/99$; $P < .01$; 16% of variance). No significant treatment effects were detected for the achievement variables in social studies.

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Insert Table 7
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The significant treatment effects in mathematics for the six attitude, process and achievement variables are explored in Table 7. The table lists the treatment group means for each of the six dependent variables. An examination of the means suggests that the two variations of the standard TGT structure (TGT-W and TGT-WNC) resulted in a lessened treatment effect. In addition, the control condition had the lowest mean scores for the attitude and achievement variables, but not for the classroom process variables. For classroom process variables, the TGT-WNC condition resulted in substantially lower levels of cohesiveness, mutual concern, and peer tutoring.

As indicated earlier, sociometric data (on friends in school and students you helped) were collected in mathematics classes as additional measures of peer group process. Two measures were derived from the data: (1) a numerical count of friends in school and students helped, and (2) a group cohesiveness measure. Results of one-way analysis of variance conducted on the number of classmates selected as friends ($F = 2.04$; $df = 3/109$, n.s.) and the number listed as having been helped by the respondent ($F = 1.57$; $df = 3/85$, n.s.) indicate no significant treatment effects measured by the numerical count.

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Insert Table 8
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The group cohesiveness measure involved using frequencies of mutual choice (Kerlinger, 1973). The cohesiveness measure is the ratio of actual number of mutual choices among classmates over the maximum possible number. A Z-test for comparing two proportions was used to compare each treatment group with the

control group (Ferguson, 1954). The treatment group ratios are listed in Table 8. Two of the three comparisons for the friends-in-school variable proved significant. TGT-W created significantly higher ($P < .001$) group cohesiveness than the control condition whereas TGT-WNC created significantly lower ($P < .01$) group cohesiveness. For the second sociometric dimension (students you helped), all three comparisons proved significant ($P < .01$), with the control group lower than all three TGT conditions. In short, the sociometric data suggests that although TGT did not affect the number of sociometric choices (on either friends or helping) made, it did increase the level of reciprocity (group cohesiveness) of such choices.

DISCUSSION

The present study assessed the effects of TGT, and two variations of TGT, on student attitudes, classroom process and student academic achievement in both mathematics and social studies. The study yielded mixed results. In mathematics, the TGT restructuring of the classroom affected attitude toward the class, classroom cohesiveness, mutual concern, peer tutoring among the students, and academic achievement (as defined by measures of divergent thinking). Unexpectedly, no treatment-by-ability interactions were noted. For social studies, only one marginally significant treatment effect was noted. A detailed discussion of the results is given below.

Subject Area Effects-Social Studies. The lack of a TGT effect in social studies should be interpreted in light of the following finding. A recently completed implementation of TGT in high school social studies classes revealed significant positive and pervasive effects of TGT (when compared to traditional instruction)

on student attitudes, classroom process and achievement (DeVries, et al., 1974). Why then were no treatment effects obtained in the present study?

A possible explanation for the lack of significant treatment effects in social studies concerns the games employed in the study. Equations, the math game employed, is a highly flexible game which allows use of a variety of mathematical concepts. As a consequence, the game could be, and was, directly related to the classroom instructional activities for the entire duration of the project. The social studies game Ameri-card, in contrast, employs a highly delimited set of concepts, namely the recognition of the various states and geographical regions of the United States. Consequently, the game was related to only a small portion of the teacher's instructional objectives, and she was able to relate her instructional activities to the game for only the first month of the project. Although the game was played for the remainder of the experimental period, the concepts being employed during the game playing session were not reinforced by the teacher during classroom instruction. It is possible that game playing became a tangential activity for the students during the last eight weeks of the study.

The experience with the Ameri-card game is an example of a more general problem with the use of instructional games in the classroom. As pointed out by the authors elsewhere (DeVries, et al., 1973), most commercially produced games employ the use of a highly circumscribed set of concepts or skills. Because the games are often appropriate only for a small subset of the instructional objectives that a teacher is likely to try to meet, their use is limited. To help overcome this limitation, the authors have developed a generalized gaming structure entitled GIGS, which allows the individual instructor to adapt games to fit instructional objectives more closely.

A variation of the GIGS structure was also used in the abovementioned study of TGT in high school social studies classes (DeVries, et al., 1974), in which widespread treatment effects were observed.

Subject Area Effects-Mathematics. TGT resulted in different outcomes in the mathematics classes than did the traditional approach. The results support in part the findings of earlier work comparing TGT with traditional instructional approaches (DeVries & Edwards, 1973; Edwards & DeVries, 1972). Of particular interest is the positive impact of TGT on tests of divergent thinking in mathematics and no impact on test of convergent thinking. This result closely parallels that obtained by Edwards & DeVries (1973). It suggests that TGT is likely to affect achievement on skill dimensions highly related to those employed during the game-playing exercises, but generalizability of such learning across skill domains appears minimal. This result alone argues for the use of a vast array of games, each employing a distinct constellation of skills and concepts.

The results for the attitude and classroom process variables largely support those obtained in DeVries & Edwards (1973). In particular, TGT created a classroom perceived by the students as more cohesive. The sociometric data suggest such increased cohesion is due less to the creation of increased interpersonal contacts than it is to the formation of more reciprocal interpersonal relations.

The data from the present study suggest that of the two forces operating in TGT--within-team cooperation and across-team competition--the former force appears to be more salient for the participants. This is reflected in part by the lack of a TGT effect on perceived competition, and a positive TGT effect on mutual concern and peer tutoring.

TGT Variations-Effects in Mathematics. Of the two TGT variations examined, the TGT form suggested by equity theory concepts (TGT-W) created few, if any, differential effects. The TGT-W treatment was designed to reduce perceived inequity on the part of high ability students; however, no significant ability-by-treatment interactions were obtained in mathematics. In addition, the means of the variables for which treatment main effects were observed indicate great similarity between TGT and TGT-W conditions.

Why did the scoring variation have little impact? It is possible that the students in the TGT condition did not perceive the 6-4-2 scoring system as inequitable. The low ability student winning at game table 10 may be perceived as having to apply as much effort (an important input) as the high ability student at table 1. Although students at table 1 may be viewed as using higher levels of skills during the game (for example, using division of fractions operations, whereas lower level table players use addition of whole numbers), it is clear that they also bring greater ability. Research by Leventhal & Michaels (1971) examined the input variable viewed by individuals as relevant to determining the level of reward a person deserved. They found that effort and performance were positively related to perceived deservingness of rewards. In contrast, more able persons were viewed as less deserving of rewards than less able individuals. In short, although the high ability students may have performed at a higher level, they may not have viewed themselves (or been viewed by others) as more deserving of rewards than their lower ability classmates.

An additional possible explanation for the apparent lack of perceived inequity in the TGT condition may lie in the aforementioned salience of cooperative forces at the team level. Perhaps most salient to all students

was not whether they brought more points back to the team than their teammates, but rather whether their team score surpassed that of competing teams. By adding a high ability student's score to those of his teammates, the apparent inequity may be submerged. An interesting but unanswered question is whether the 6-4-2 scoring would be viewed as inequitable by the students in a classroom structured around individual competition.

A final point concerning the weighted vs. unweighted scoring issue concerns the general level of satisfaction expressed by the students with the game structure, including the scoring system. Data collected from a posttest questionnaire suggest that the TGT condition students were in no way bothered by the 6-4-2 scoring. When asked if they enjoyed playing the game, 100% of the TGT students answered "yes." Had the scoring system been perceived as inequitable, the students' response to the item would probably have been less enthusiastic.

The test of the second variation of TGT--deleting the team competition component--was, unfortunately, an indirect one. The no team-competition treatment group was also characterized by the weighted scoring system; consequently, the test of the importance of team competition is confounded with that of the weighting of game scores. The comparison that can be made is TGT-WNC with the TGT-W condition, and not TGT-WNC with TGT. Comparing the means for the math class variables listed in table 7, a general trend can be observed. For five of the six dependent variables the TGT-WNC condition had a significantly lower score on the friends-in-school measure of group cohesiveness. This pattern supports Bronfenbrenner's (1970) and others' convictions that group processes are enhanced when the group faces an external threat, such as in group competition. The test is weak, however, and the results are merely suggestive. Considerable further work is required to assess the role of team competition in TGT.

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Table 1

Summary of Dependent Variable Measures Used

Dependent Variable	Subtest Area: Mathematics	Subtest Area: Social Studies
Achievement	Divergent Solution tests-I Divergent Solutions test-II Computations Number Sentences	Maps States Capitols
Attitudes	Satisfaction Difficulty Toward Class	Satisfaction Difficulty Toward Class
Classroom Process	Competition Cohesiveness Mutual Concern Normative Climate Frequency of tutoring	Competition Cohesiveness Mutual Concern Normative Climate Frequency of tutoring
Sociometric Choice	friends in school classmates you helped	

Table 2

Summary of Results for Mathematics Classes

Dependent Variable	Ability A	Treatment B	Interaction A X B
Attitude			
Satisfaction	.01	---	---
Difficulty	.01	---	---
Toward Class	---	.05	---
Class Process			
Competition	---	---	---
Cohesiveness	.05	.10	---
Mutual Concern	.05	.10	---
Normative Climate	---	---	---
Frequency of tutoring	.10	.05	---
Achievement			
Solutions I	.01	.01	---
Solutions II	.01	.01	---
Computations	.01	---	---
Number Sentences	.01	---	---

Table 3

Summary of Results of Social Studies Classes

Dependent Variable	Ability A	Treatment B	Interaction A X B
Attitude			
Satisfaction	.01	---	.05
Difficulty	.01	---	---
Toward Class	.01	---	---
Classroom Process			
Competition	---	---	.10
Cohesiveness	---	---	---
Mutual Concern	---	---	---
Normative Climate	.05	.10	---
Frequency of tutoring	---	---	---
Achievement			
Maps	.01	---	---
Capitols	.01	---	---

Table 4

Multiple Regression Analyses Results

for Attitude Variables

Dependent Variable	Source of Variance	DF_1	Mathematics Incremental R^2	Mathematics F Ratio[1]	Social Studies Incremental R^2	Social Studies F Ratio[2]
Satisfaction	A	1	.05	5.49**	.06	7.61**
	B	3	.02	< 1	.01	< 1
	A X B	3	.01	< 1	.07	2.82*
	Total		.09		.14	
Difficulty	A	1	.11	14.48**	.03	3.91*
	B	3	.04	1.61	.06	2.12
	A X B	3	.04	1.52	.02	< 1
	Total		.19		.11	
Attitude Toward Class	A	1	.01	1.18	.07	8.18**
	B	3	.07	2.70*	.01	< 1
	A X B	3	.01	< 1	.02	< 1
	Total		.09		.10	

**P < .01

*P < .05

[1] $df_2 = 103$ [2] $df_2 = 104$

A = Ability effect B = Treatment effect

Table 5

Multiple Regression Analyses Results for Classroom Process Variables

Dependent Variable	Source of Variance	DF_1	Mathematics Incremental R^2	Mathematics F Ratio[1]	Social Studies Incremental R^2	Social Studies F Ratio[2]
Competition	A	1	.01	1.67	.00	< 1
	B	3	.02	< 1	.03	< 1
	A X B	3	.04	1.30	.06	2.28*
	Total		.07		.09	
Cohesiveness	A	1	.05	5.56**	.00	< 1
	B	3	.06	2.36*	.03	< 1
	A X B	3	.01	< 1	.01	< 1
	Total		.12		.04	
Mutual Concern	A	1	.04	4.82**	.00	< 1
	B	3	.06	2.52*	.02	< 1
	A X B	3	.05	1.93	.05	1.81
	Total		.15		.07	
Normative Climate	A	1	.00	< 1	.04	4.09**
	B	3	.04	1.28	.06	2.16*
	A X B	3	.03	1.02	.02	< 1
	Total		.07		.12	
Frequency of Tutoring	A	1	.03	3.26*	.00	< 1
	B	3	.08	3.15**	.05	1.76
	A X B	3	.02	< 1	.01	< 1
	Total		.13		.06	

*P < .10
**P < .05

[1] $DF_2 = 103$

[2] $DF_2 = 104$

Table 6

Multiple Regression Analyses Results for Mathematics and Social Studies Achievement Variables

Dependent Variable	Source of Variance	DF_1	Incremental R^2	F Ratio
MATHEMATICS				
Solutions I	A	1	.46	105.98**
	B	3	.09	7.28**
	A X B	3	.01	< 1
			.56	
Solutions II	A	1	.30	58.37**
	B	3	.16	10.01**
	A X B	3	.01	< 1
			.47	
Computations	A	1	.27	38.92**
	B	3	.00	< 1
	A X B	3	.03	1.32
	Total		.30	
Number Sentences	A	1	.25	34.56**
	B	3	.01	< 1
	A X B	3	.01	< 1
	Total		.27	
SOCIAL STUDIES				
Maps	A	1	.30	43.09**
	B	3	.01	< 1
	A X B	3	.02	< 1
	Total		.33	
Capitols	A	1	.24	32.43**
	B	3	.01	< 1
	A X B	3	.04	1.64
	Total		.29	

*P < .05
**P < .01

A = Ability effect B = Treatment effect

Math variables $DF_2 = 99$

Social Studies variables $DF_2 = 95$

Table 7

Within Group Means for Variables with Significant Treatment Effects in Mathematics

Dependent Variable	TREATMENT GROUP Control	TGT	TGT-W	TGT-WNC	Percent of Variance Explained by Treatment
Attitude toward class	5.61	5.89	5.96	5.67	7%
Cohesiveness	8.81	9.11	9.00	8.59	6%
Mutual Concern	5.52	5.96	5.46	5.15	6%
Frequency peer Tutoring	6.26	6.74	6.04	5.77	8%
Solutions I	4.26	7.36	6.22	5.48	9%
Solutions II	8.00	14.68	10.63	12.00	16%
Average Rank	3.2	1.2	2.3	3.3	

Table 8

Treatment Group Cohesiveness as Measured by Mutual Choices on Four Sociometric Variables

Sociometric Choice Variable	Treatment Group			
	Control	TGT	TGT-W	TGT-WNC
Friends in School	.32 (139)	.35 (131)	.40** (162)	.26* (83)
Students you Have helped	.05 (19)	.13** (33)	.11* (20)	.14** (24)

[1] Numbers in parentheses are number of mutual choices made. The cohesiveness is measured by the decimal fraction which is the ratio of the number of mutual choices over the total possible number of mutual choices. For the two variables the total possible is given by $n(n - 1)/2$ when n is the number of subjects responding.

* Significantly different from the control group $P < .01$
** Significantly different from the control group $P < .001$

Evaluated using Z - test for difference between proportions (Ferguson, 1954).